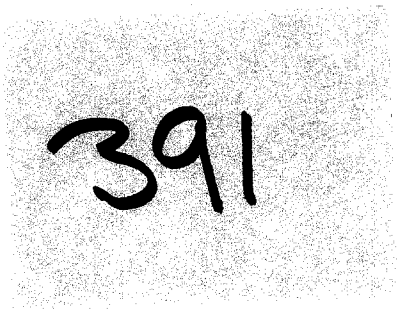
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COPY

March 9, 2005

Project No. 1010.02

Ms. Stephanie Sibbett
BOEING REALTY CORPORATION
4900 East Conant Street
Building 1
Long Beach, California 90808

Work Plan Groundwater Monitoring Well Installation
(LARWQCB File No. 95-036, SLIC No. 0410)
Former Boeing C-6 Facility
Los Angeles, California

Dear Ms. Sibbett:

This work plan presents the scope of work for the installation of 3 ground water monitoring wells at the Boeing Realty Corporation's (BRC's) former C-6 Facility (the site) in Los Angeles, California. The overall objective is to further delineate the extent of chemical constituents of interest in the Gage Aquifer and the Bellflower C-Sand and comply with the recent LARWQCB Order (LARWQCB, March 2005). The site location is shown in Figure 1 and a plan of the site is presented in Figure 2. Well installation procedures and schedule for implementation of this work plan are presented in the following sections.

BACKGROUND INFORMATION

Two wells will be installed in the Gage Aquifer and one well will be installed in the C-Sand. The C-Sand monitoring well (CMW009, Figure 3) was included in the Site-Wide Groundwater Monitoring Work Plan (Haley & Aldrich, March 31, 2003) and was approved by LARWQCB in a letter dated May 28, 2003. A brief summary of background information and the rationale for installation of these wells are presented below.

BRC also plans to install 5 additional monitoring wells into the Bellflower Aquitard as per the Site-Wide Groundwater Monitoring Work Plan (Haley & Aldrich, March 31, 2003). These wells were also approved by LARWQCB on May 28, 2003. These five proposed ground water monitoring wells (two C-Sand and three B-Sand) are scheduled to be installed when site redevelopment by the current occupants is completed (BRC, February 28, 2005). The locations of the proposed B-Sand and C-Sand wells are presented in Figures 2 and 3, respectively.

Gage Aquifer Wells

The U.S. Environmental Protection Agency (U.S. EPA) is the lead agency for investigation and remediation of the Montrose and Del Amo sites located to the east and south of the Former C-6 Facility. Recent groundwater quality data collected from wells associated with the Montrose and Del Amo sites show the presence of trichloroethene (TCE) and other chlorinated compounds in

16 TECHNOLOGY • SUITE 138 • IRVINE, CALIFORNIA 92618
(949) 296–1177 • (949) 296–1178 FAX

the Gage Aquifer. Additionally, investigations at the facilities located immediately east of the site have also shown the presence of TCE and other chlorinated compounds in the subsurface environment. The Regional Water Quality Control Board, Los Angeles Region (LARWQCB) is the oversight agency for these facilities. The U.S. EPA and LARWQCB intend to develop additional water quality data to further characterize the extent of volatile organic compounds in the Gage Aquifer. To accommodate U.S. EPA and LARWQCB investigative efforts, BRC has chosen to install two wells at the site that will be screened in the Gage Aquifer. The locations of these wells generally coincide with locations previously suggested by the U.S. EPA.

SCOPE OF WORK

The anticipated scope of work includes permitting and utility clearance, drilling and soil sampling, well installation, and well development. Work with be performed in accordance with the standard operating procedures (SOPs) for drilling, soil sampling, well installation, well development, and related activities (Haley & Aldrich, December 3, 2004). Copies of the SOPs are included in Attachment No. 1. However, additional details and any deviations from the SOPs are provided below.

Permitting and Utility Location

Prior to initiation of site investigative activities, permits will be obtained from the Los Angeles County Department of Health Services for the drilling and installation of ground water wells. Also, prior to any drilling activities, proposed boring locations will be marked on the ground with white spray paint and Underground Service Alert will be notified a minimum of two working days in advance to allow adequate time for marking the locations of subsurface utilities.

Notifications

Notification will be given to LARWQCB, U.S. EPA, and other stakeholders at least 5 days prior to planned drilling activities.

Health and Safety

Work will be conducted under the Site-Specific Health & Safety Plan prepared for BRC (Haley & Aldrich, June 8, 2001). A site safety plan form will be prepared that will include updated contacts and anticipated potential hazards.

Drilling and Well Installation – Gage Aquifer

Proposed Gage Aquifer Wells MWG001 and MWG002 will be drilled to a total depth of approximately 180 feet (35 feet below the top of the Gage Aquifer) using a mud-rotary casing hammer drill rig equipped with a 10-inch diameter drill bit or using a sonic drill rig. The proposed locations of Wells MWG001 and MWG002 are shown in Figure 4.

Initially, drilling will include conductor casing that will extend into the Lower Bellflower Aquitard (LBF). Previous continuous core sampling at the Lot 8 site have shown the top of the LBF occurring between 122 and 125 feet bgs and may be only 3 feet thick. The conductor

casings will consist of 10-foot long sections of flush-threaded, mild steel drive casing, and will be driven into the ground using a pneumatically operated hammer mounted on the drill rig mast. For a mud rotary rig, the drive casing will be approximate 9-inch or 12-inch inside diameter depending on the drill bit used. Once the conductor casing is set, all water/mud from the boring will be removed (bailed or air lifted) to minimize the potential for cross-contamination. Also, to avoid impacts from the Bellflower Aquitard, the drilling mud will be replaced prior to drilling into the Gage Aquifer.. The cuttings generated by the drill bit at the base of the casing will be removed from each boring by forcing drilling fluid consisting of bentonite, formation material, and water (drilling mud) through the hollow drill rod, out the drill bit, and up through the annulus between the drill rod and temporary casing. Soil cuttings will be separated from the drilling mud using a baffled "shaker" and collected in a "hopper" bin. The cuttings will be transferred periodically from the hopper into roll-off bins placed near the borings.

If sonic drilling methods are used, and 8-inch diameter drive conductor casing and 6-inch diameter telescoped casing will be used. For sonic drilling there will be minimal cuttings and no drilling mud generated. Sonic drilling, if utilized, will be performed in accordance with the procedures outlined in the Montrose Work Plan for TCE Data Acquisition (Hargis + Associates, June 2004) as requested by U.S EPA.

To characterize the lithology and to determine the depths at which the Lower Bellflower Aquitard and Gage Aquifer are encountered at each boring location, continuous coring will be performed for sonic drilling. For mud rotary drilling, geophysical logging will be performed throughout the boring, and continuously cored beginning at approximately 110 feet bgs until reaching the LBF/Gage Aquifer interface. The wells will be drilled to a depth of 35 feet below the top of where the Gage Aquifer is first encountered. The wells will be constructed using flush-threaded, Schedule 40 PVC casing and will include 30 feet of 0.02-inch slotted screen. The casing diameter will be 2-inch for sonic drilling and 4-inch for mud rotary drilling. Each well will be centered in the borings using centralizers. Centralizers will be placed at each end of the well screen and at 50 foot intervals as the well casings are lowered into the well borings using a winch on the drill rig. Once the casings are installed to the desired depth, the wells will be completed with sandpack material, bentonite pellets, and cement-bentonite grout. Specifically, the annular space around the screened sections will be packed with sand no finer than No. 2/16 grade silica sand to at least 3 feet above the top of the screened interval. Approximately 5 feet of bentonite pellets will be placed above the sand pack. After the bentonite pellets are given sufficient time to hydrate, the remaining annular space will be sealed with cement-bentonite grout to approximately 2 to 3 feet from surface grade. For mud rotary drilling, the sandpack, bentonite pellets and cement-bentonite grout will be tremmied through 2-inch diameter PVC tremmie pipe. For sonic drilling, the sandpack will first be installed from the surface. The well casing will then be surged to settle the sandpack. Bentonite pellets with a time-release coating will then be installed from the surface. The cement bentonite grout will then be tremmied using a 1-inch diameter tremmie pipe. The wells will be completed at the surface with 12-inch diameter, flush-mounted, well boxes encased in concrete.

Other than as described above, soil sampling, sample handling, and well installation will be performed as described in the SOPs.

Drilling and Well Installation – Bellflower Aquitard

The C-Sand well boring will be drilled to a depth of approximately 115 feet bgs, respectively. The location C-Sand Well MWC009 is shown in Figure 3. Well installation will be performed using the same drilling method as utilized to install the Gage Aquifer wells. Since this well is located adjacent to the proposed Gage Aquifer Well MWG001, there will be no soil sampling or geophysical logging. Drilling, soil sampling, and sample handling will be performed as described in the SOPs (Attachment No. 1). Soil cuttings will be handled as described above for the Gage aquifer well installation.

The well boring will be completed by placing 4-inch diameter Schedule 40 PVC blank casing with 20 to 25 feet of slotted 0.020-inch well screen through the hollow stem of the 10-inch diameter augers. As the augers, in effect, centralize the casings in the boreholes, no centralizers will be used. The wells will be constructed in accordance with procedures outlined in the SOPs.

Well Development

Upon completion, each well will be developed to remove fine-grained material from the well casing, sandpack, and the adjacent formation. Development will be conducted in accordance with the procedures outlined in the SOPs.

Surveying

Each monitoring well will be surveyed for location and elevation. Well locations and well-head elevations will be surveyed to the nearest 0.5 feet and 0.01 foot, respectively, at a marked reference point on each well casing. Horizontal coordinates and vertical elevations will be established using California State Plane Zone 5 Coordinates and North American Vertical Datum of 1988 (NAVD 88) Orthometric Heights, respectively.

Equipment Decontamination

To minimize the potential for cross-contamination, soil sampling equipment likely to come in direct contact with the soil samples will be thoroughly cleaned prior to introduction to the boring by scrubbing in a detergent solution, and rinsing with potable water. This cleaning procedure will be repeated between successive sampling points to avoid cross-contamination at different depth intervals. Drilling equipment considered unlikely to come into direct contact with the soil samples will be steam cleaned prior to the first boring and between successive borings.

Other than as described above, decontamination procedures for equipment will be performed as provided by the SOPs.

Groundwater Sampling

The wells will be monitored and sampled according to the procedures set forth in the Groundwater Monitoring Work Plan 2005 (Haley & Aldrich, November 2004). This Plan

includes full data validation as required by LARWQCB. The wells will be sampled within two weeks following installation and sampled quarterly for three additional events following. After the first four events, the wells will be sampled semi-annually.

REPORTING

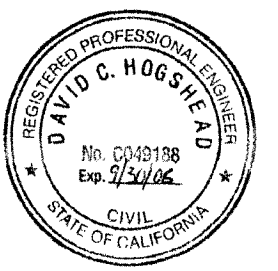
Subsequent to completion of the proposed wells, a brief draft report will be prepared for BRC's review. The report will include a description of well installation procedures, well logs, results of the survey and groundwater sampling results. The report will be finalized upon receipt and consideration of comments from BRC.

SCHEDULE

The duration of the proposed scope of work outlined herein is estimated to be 5 to 6 weeks from authorization to proceed. Pre-field activities including permitting and notification are anticipated to take two weeks. Drilling, well installation, and well development are anticipated to take 3 to 4 weeks to complete.

Respectfully Submitted,

RUBICON ENGINEERING CORPORATION



Mohsen Mehran, Ph.D.	Darren Brandner, P.E.	David C. Hogshead, P.E.
Project Director	Senior Engineer	Senior Engineer

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California Regional Water Quality Control Board, Los Angeles Regions, May 28, 2003, *Work Plan Approval, Groundwater Monitoring Workplan, Boeing Realty Corporation, Former C-6 Facility, 19503 Normandie Avenue, Los Angeles (File No. 95-036).* Submitted to Brian Mossman, Boeing Realty Corporation.

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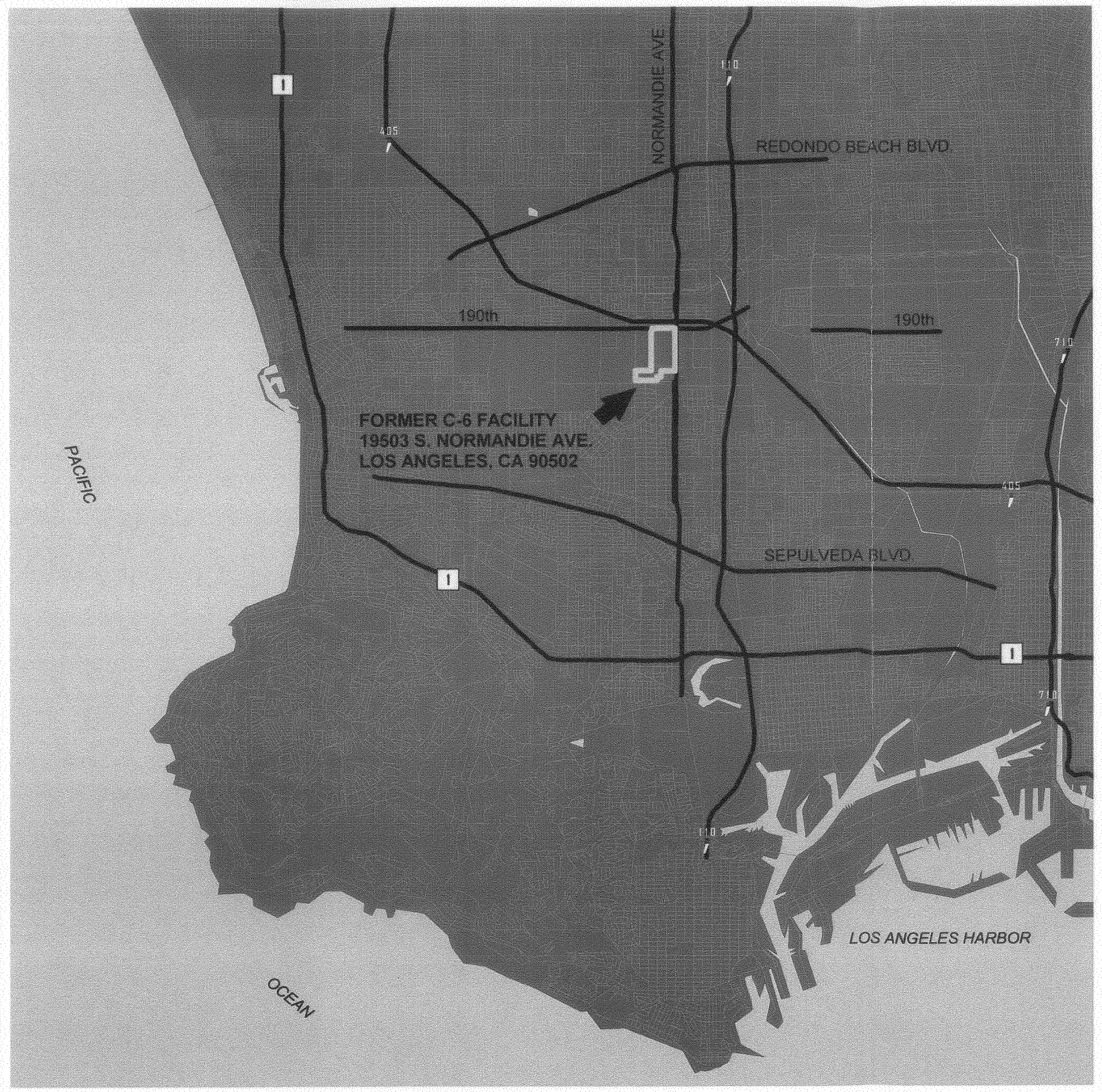
Figures



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EXPLANATION

BOEING REALTY CORPORATION:
FORMER C-6 FACILITY

REFERENCE:
Base map downloaded from 'Tiger File' data website hosted by ESRI.

0 1 2 Miles

APPROXIMATE HORIZONTAL SCALE

FIGURE 1

SITE LOCATION MAP

FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

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ENGINEERING

BOE-C6-0067075

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BOEING REALTY CORPORATION
FORMER C-6 FACILITY

INTERNATIONAL LIGHT METALS

CAPITOL METALS

ECOLOGY CONTROL INDUSTRIES

AMERICAN POLYSTYRENE

PACCAR

MIGHTY USA

MONTROSE

JONES CHEMICAL

FARMER BROTHERS

NORMANDIE

190TH STREET

PACIFIC GATEWAY

WESTERN AVENUE

DEL AMO BLVD

204TH STREET

P-12 (2200)
P-24 (360)
P-5 (7.7)
DAC-P1 (690)
P-1 (6600)
P-9B (140)
P-20 (5000)
P-17 (2200)
MW-6B (730)
P-7 (1400)
BL-03 (660)
P-10 (10)
P-22 (850)
MWB008
(960)
WCC_03S
TMW_01 (840)
TMW_02 (5500)
MWB010
WCC_04S (380)
WCC_05S (1.5)
WCC_06S (360)
TMW_08 (2100)
TMW_09 (500)
TMW_07 (1300)
WCC_09S (56)
MWB013 (3.4)
TMW_04 (1500)
MWB012 (1000)
MW0005 (2500)
TMW_15 (18)
TMW_10 (4.2)
TMW_06 (160)
MWB014 (220)
TMW_14 (9.1)
MWB019 (120)
TMW_11 (9)
BL-11C (3200)
MW-08 (<2)
MW-09 (40)
XMW-09 (32)
MW-04 (56)
MW-05 (<2)
MW-03 (110)
MW-06 (1100)
MW-17 (<2)
MW-14 (59)
MW-10 (16)
MW-27 (17)
MW-11 (5.5)
MW-12 (5.8)
MW-13 (480)
MW-01T (240)
MW-02T (1300)
MW-03T (18000)
MW-04T (3100)
MW-05T (46000)
MW-06T (8000)
MW-07T (3100)
MW-08T (750)
XMW-19 (6.1)
MW-01T
MW-21 (<50)
MW-29 (<2)
MW-30 (<2)
PZL0003 (2.3)
PZL0014 (<1)
SWL0007 (<1.4)
PZL0009 (0.72)
PZL0016 (1400)
SWL0003 (3900)
SWL0004 (<1)
PZL0021 (<500)
SWL0016 (1.8)
SWL0017 (<1)
PZL0006 (3.6)
SWL0044 (<50)
PZL0020 (<500)
PZL0025 (<1)
SWL0008 (<500)
PZL0022 (<1)
SWL0051 (339)
SWL0006

N

0 500 1,000 FEET
APPROXIMATE SCALE

LEGEND

- MW-01 (240) — WATER TABLE/B-SAND MONITORING WELL SHOWING TCE CONCENTRATION (ug/L)
- MWB008 — PROPOSED B-SAND WELL
- PROPERTY BOUNDARY

NOTE:
DATES OF GROUNDWATER SAMPLING EVENTS ARE AS FOLLOWS:

DEL AMO - January 2004
MONTROSE - January 2004
BRC C-6 FACILITY - March - May 2004
ILM - September 2003 - April 2004
AMERICAN POLYSTYRENE - January 2004
PACCAR - 2003

FIGURE 2

B-SAND WELLS

FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

RUBICON ENGINEERING

BOE-C6-0067076

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BOEING REALTY CORPORATION
FORMER C-6 FACILITY

INTERNATIONAL LIGHT METALS

CAPITOL METALS

MONTROSE

JONES CHEMICAL

FARMER BROTHERS

ECOLOGY CONTROL INDUSTRIES

AMERICAN POLYSTYRENE

PACCAR

MIGHTY USA

NORMANDIE

190TH STREET

PACIFIC GATEWAY

KNOX ST

WESTERN AVENUE

DEL AMO BLVD

204TH STREET

MWC04D

MWC011

MWC009

P-16C ⊕ (700)

MWC021 (6.5)

SWL0029 ⊕ (3100)

MWC15 ⊕ (1600)

MWC016 ⊕ (660)

CMW026 ⊕ (1300)

MWC017 ⊕ (910)

CMW001 ⊕ (125)

BF-19 ⊕ (<2)

CMW002 ⊕ (540)

BL-11C ⊕ (180)

BF-09 ⊕ (240)

BF-03 ⊕ (710)

BF-05 ⊕ (<2)

BF-02 ⊕ (400)

BF-04 ⊕ (170)

BF-06 ⊕ (70)

BF-20 ⊕ (<40)

BF-07 ⊕ (110)

SWL0049 ⊕ (53)

SWL0047 ⊕ (<1)

SWL0037 ⊕ (<1)

SWL0048 ⊕ (25)

SWL0050 ⊕ (<1,000)

SWL0041 ⊕ (<1,000)

SWL0052 ⊕ (0.56)

N

0 500 1,000 FEET
APPROXIMATE SCALE

LEGEND

- MW-01 ⊕ (240) — C-SAND MONITORING WELL SHOWING TCE CONCENTRATION (ug/L)
- MWC009 — PROPOSED C-SAND MONITORING WELL
- PROPERTY BOUNDARY

NOTE:
DATES OF GROUNDWATER SAMPLING EVENTS ARE AS FOLLOWS:

DEL AMO - January 2004
MONTROSE - January 2004
BRC C-6 FACILITY - March - May 2004
ILM - September 2003 - April 2004

FIGURE 3

C-SAND WELLS

FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

RUBICON ENGINEERING

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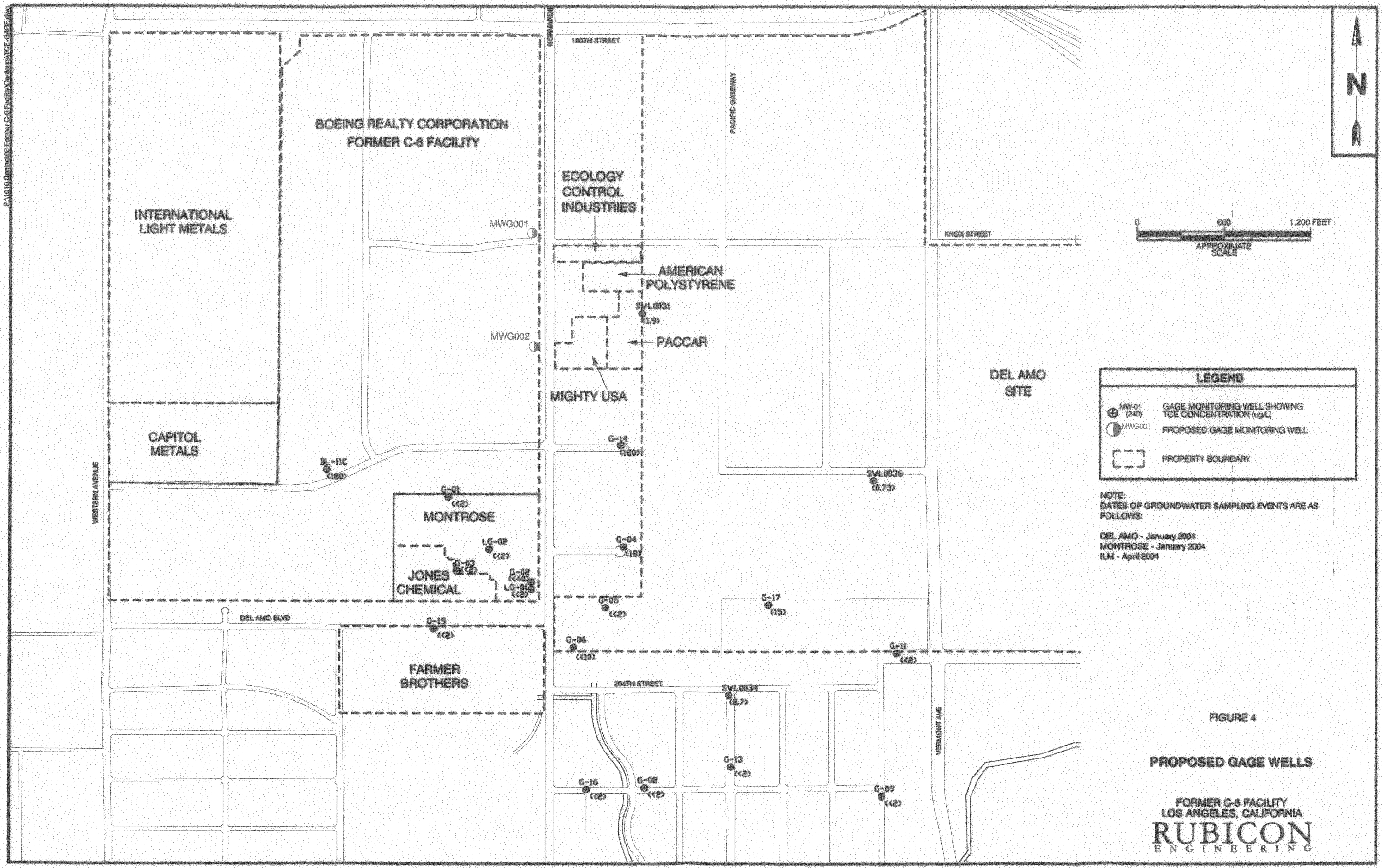

LEGEND

- MW-01 (240) — GAGE MONITORING WELL SHOWING TCE CONCENTRATION (ug/L)
- MWG001 — PROPOSED GAGE MONITORING WELL
- PROPERTY BOUNDARY

NOTE:
DATES OF GROUNDWATER SAMPLING EVENTS ARE AS FOLLOWS:

DEL AMO - January 2004
MONTROSE - January 2004
ILM - April 2004

FIGURE 4

PROPOSED GAGE WELLS

FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

RUBICON ENGINEERING

Attachment No. 1

Standard Operating Procedures

WELL CONSTRUCTION AND DESTRUCTION STANDARD OPERATING PROCEDURES FOR LOT 8 – PARCEL C GROUNDWATER REMEDIATION WELL INSTALLATION PROGRAM FORMER BOEING C-6 FACILITY LOS ANGELES, CALIFORNIA

by:

Haley and Aldrich, Inc.
San Diego, California

for:

Boeing Realty Corporation
Long Beach, California

File No. 28882-604
16 August 2004
Revised: 3 December 2004

HALEY& ALDRICH

1. INTRODUCTION

The purpose of this document is to present the standard operating procedures (SOPs) required for installing and constructing 163 amendment wells (AWs) and seven groundwater monitoring wells (MWs) in Parcel C of the former Boeing C-6 facility (Site) in Los Angeles, California. The wells are to be installed as part of the groundwater remediation program for the Site. This document also presents the procedures to be used if an AW or MW has to be destroyed.

The AWs and MWs will be installed into the B-Sand or the C-Sand in five phases of work, described below:

- Phase I – 16 geologic reconnaissance AWs will be drilled at selected locations in Lot 8 and Parcel A of the Site;
- Phase II – 20 AWs will be installed in Parcel A of the Site;
- Phase III – 41 AWs and six soil vapor extraction wells will be installed in the graded pad of the future building planned for Lot 8.
- Phase IV – 86 AWs will be installed in Lot 8 in areas outside the area of the building pad.
- Phase V – seven MWs will be installed in Lot 8 and Parcel A following development of the Site.

This well installation SOP addresses the following items:

- Pre-drilling activities
- AW and MW well design
- Well installation procedures
- Well destruction procedures

2. PRE-DRILLING ACTIVITIES

The pre-drilling activities addressed in this section include: permits, well location selection and marking, utility clearance, equipment assembly, field documentation, and construction methods documentation.

2.1 Well Permits

Los Angeles County Department of Health Services (LACDHS) requires permits for the injection and monitoring wells. These permits must be obtained for all wells installed at the Site. Upon receipt of the Well Installation Permits, LACDHS requires at least 48-hours notification prior to well installation. Installation of the AWs and MWs should not proceed until approval (written or verbal) has been obtained from the LACDHS.

2.2 Pre-field Documentation and Checklists

The following documents and checklists will be prepared and maintained on-Site during the field activities:

- Site-specific Health and Safety Plan;
- Pre-field Checklist;
- Incident reporting Procedures; and
- Standard Operations Checklist and Dash Card.

2.3 Project Team Kick-off Meetings

Prior to the initial mobilization to the field, a project team kick-off meeting will be held to review the scope of work and the Well Installation Implementation Plan. Attendees to this pre-field kick-off meeting will include Haley and Aldrich's Project Manager and Task Leader, the driller's Project Manager, and the Boeing Project Manager. The kick-off meeting will also discuss and clarify the rolls and responsibilities of project team members during the well installation program, and discuss the schedule of events during the field program. If any changes to the scope or SOPs to be used during the well installation program are identified during the pre-field kick-off meeting, the Implementation Plan and appropriate SOPs will be revised.

One the first day of field work for each of the five phases of the well installation program, a field kick-off meeting will be conducted at the Site. Attendees will include at a minimum Haley and Aldrich's Task Manager, Field Coordinator/Supervising Geologist, Health and Safety Coordinator, and the Oversight Geologist(s), the driller's Task Leader, and the Boeing Project Manager.

2.4 Well Locations and Marking

The locations of the proposed AWs and MWs are shown on Figure 2 of the Implementation Plan. The locations of the AWs and MWs are based on the California Regional Water Quality control Board - Los Angeles Region (LARWQCB) approved locations presented in the work plan for the groundwater remediation pilot study (Arcadis, 2002). The installation phase and well construction details of each well to be installed are presented in Table II of the Implementation Plan. Prior to each phase of the well installation activities, a surveying subcontractor will survey the locations of each of the AWs or MWs to be installed during that phase of work. Locations are to be marked with wood stakes and flagging. Any off-set of wells required by access limitation will be measured and noted in the Daily Field Report and the Well Completion Log.

2.5 Utility Clearance

After the well boring locations have been marked, each location will be assessed as to the potential presence of subsurface utilities or known obstructions. The task manager or his/her delegate should identify alternate well boring locations in the event that utilities or other subsurface obstructions are present at the pre-selected locations. In addition, Underground Service Alert (USA) will be notified prior to the advancement of any boring on-site (USA requires at least a 3 business-days notice). Because of on-going development, well locations in Parcel A and the southern portion of Lot 8 along Knox Street will also be cleared for subsurface utilities by a geophysical locator subcontractor and hand augered to a depth of 10 ft below ground surface (bgs) prior to drilling. The remaining well locations in Lot 8 do not require hand auger clearance.

The seven proposed monitoring wells will be installed during Phase V of the installation program, following complete development of the Site. To protect newly installed utilities, each MW location will be cleared by the geophysical locator subcontractor, USA, and will also be hand augered to a depth of 10 ft bgs in a triangular pattern surrounding the well location.

2.6 Concrete Cutting

Some well boring locations may require concrete/asphalt cutting to gain access to the underlying soil. If necessary, well locations will typically require a 2-foot by 2-foot area of asphalt or concrete to be removed to provide sufficient space for the installation of a monitoring well or wells and completion of the well box or protective casing.

2.7 Instrument Calibration and Equipment Organization

Prior to drilling, field equipment will be checked for possible malfunctions, cleaned, and

calibrated. Instruments to be used during well installation and development include:

- Photo Ionization Detector (PID) for work area air monitoring and headspace analysis of soil cuttings;
- Electronic water level sounder;
- Water quality parameters (e.g., pH, electroconductivity, temperature, turbidity and dissolved oxygen) for monitoring purge water quality during well development; and
- Pressure transducers to monitor groundwater levels during development pumping and injection testing.

Calibration procedures provided by the manufacturers should be followed for each instrument. Calibration verification will be performed in the field prior to initial instrument use, at least once a day, or when any indication of instrument malfunction is observed. Oversight geologists are responsible for documenting the calibration verification readings and associated notes for each day that the instruments are used. This information may be recorded in the field activity logbook or on the approximate field instrument calibration log.

Following the maintenance and calibration of all field instruments, the equipment and materials necessary to support the monitoring well installation task will be assembled.

2.8 Field Documentation

A Daily field Report will be maintained to document field activities associated with the installation of AWs and MWs. Well construction and development details will be logged (along with any other comments that will aid in the ability to reconstruct the drilling activities without reliance on memory) on the monitoring well construction diagrams (Appendix A – Field Forms) and the Daily Field Report. Entries will be made in waterproof black ink. In the case of an error, corrections will be made by crossing a single line through the incorrect information and entering the correct information. All corrections will be initialed and dated.

The following information will be recorded during well installation:

- Drilling contractor's name;
- Drilling method;
- Date of installation;
- Depth of borehole;

- Name of oversight geologist;
- Well number and location with measurements to nearby landmarks;
- Site name and project number;
- Types of construction material and quantity of material (screen type and length, volumes of filter pack, bentonite chips and cement/bentonite grout, mixture of grout, etc.);
- Methods of placement of filter pack, bentonite seal, and annular Portland cement/bentonite seal;
- Static water level after well installation;
- Total depth of well after installation and description of bottom (i.e., hard, soft, etc.);
- Location and description of survey measuring point on well casing;
- Description of fluids added during installation (composition, source, and volume).

All geologic logs, well construction and well development record forms will be provided to the Boeing Technical Manager every two days for review via email. The email transmittal will also include a summary of activities and any deviations from the Implementation Plan experienced in the field. Geologic description and well construction details will also be included in an electronic object log and uploaded to the Boeing EDMS. A complete set of all field activity logs and field forms will be transmitted on CD to the Boeing Project Manager upon completion of each phase of work.

3. AMENDMENT WELL AND MONITORING WELL DESIGN

The AWs and MWs have similar designs and installation procedures. The designs for the B-Sand and C-Sand AW and MWs are described in Sections 2.1 and 2.2, respectively. The procedures to be used during installation of the AWs and MWs are described in Section 2.3

3.1 B-Sand Amendment Wells and Monitoring Wells

The typical well diagrams of the B-Sand AWs and MWs are shown on Figures 4 and 5 of the Implementation Plan, respectively. A total of 107 AWs and three MWs will be installed in the B-Sand. The B-Sand water bearing unit AWs and MWs will be constructed to the following design:

- A total of 53 Upper B-Sand AWs to a bottom elevation of -36 ft msl will be installed.
- A total of 4 Lower B-Sand AWs to a bottom elevation of -46 ft msl will be installed.
- A total of 50 combined lower B-Sand and Upper B-Sand AWs to a bottom elevation of -46 ft msl will be installed.
- A total of three B-sand MWs will be installed to an elevation of -36 ft msl.
- The total depth of the AWs will be based on the surveyed elevation of the ground surface at each AW location and the target screened interval elevations identified in Table II.
- The lengths of the screened intervals will be as follows:
  - Upper B-Sand (UBS) AWs = 20 ft
  - Lower B-Sand (LBS) AWs = 10 ft
  - Combined UBS and LBS AWs = 30 ft
- All AW and MWs will be drilled with 8-inch outside diameter by 5 ft long hollow stem augers.
- The B-Sand AWs will be constructed with 2-inch diameter Schedule 40 PVC casing and screens with 0.020-inch machine cut slots.
- The MWs will be constructed with 2-inch diameter Schedule 40 PVC casing and screens with 0.010-inch machine cut slots.
- The filter pack material to be used for the injection wells will be No. 3 Monterey sand, or equivalent. The filter pack material to be used for the groundwater monitoring wells will be No. 2/12 sand, or equivalent. The AW and MW filter pack specification were reviewed based on the results of the sieve analyses performed on 12 soil samples collected during the Phase I geologic reconnaissance program and were found to be adequate for the soils present in the proposed screened intervals. The small amounts of formation sediment bailed during development of the Phase I AWs also support the continued use of the No. 3 Monterey sand as a filter pack. The filter pack will be installed from total depth to 1 ft above the top of the screened interval.

The method of placement and settlement of the filter pack is described in Section 2.3;

- The bentonite seal of the Lower B-Sand AWS and the C-Sand AWs are to consist of 5 ft of ¼-inch WYO-BEN coated pellets, or equivalent, placed in 12-inch thick maximum lifts. The bentonite seal of the upper B-Sand and Combined UBS/LBS AWs are to consist of ¼-inch diameter uncoated medium bentonite chips placed in 12-inch thick maximum lifts. To prevent premature hydration of the bentonite during placement, the WYO-BEN coated pellets should be used if more than 10 ft of standing water is present above the seal depth. This depth shall be measured prior to placement of the bentonite seal. The thickness, hydration, and placement of the bentonite seal are critical to seal-off adjacent water bearing zones and facilitate injection into the target VOC-impacted water bearing units. The method of placement and hydration of the bentonite seal is described in Section 2.3;
- The remaining annular seal will consist of a Portland cement grout with approximately 4 percent bentonite powder added by weight. The mixture and procedure for placement of the annular seal is described in Section 2.3.
- As the filter pack, bentonite seal and cement/bentonite grout are placed, the augers can be withdrawn. However, to prevent the formation material from caving around the well screen and casing, at no time shall the base of the augers be allowed to rise above the top of the placed filter pack, bentonite seal or grout level.
- The grout seal will be placed to within 3 ft of grade.
- Because connection of the AWs to the manifold piping will be performed immediately following well installation, a minimum of 2 ft of stickup of the well casing will remain above grade for the piping contractor to cut down during the pipe fitting process. The piping contractor will trench to the AWs and connect each well to the injection piping according to the specifications.
- The level of the grout seal in each well will be periodically inspected for one week following installation to observe any settling of the grout. If settlement is observed, additional grout will be mixed and added to bring it within 3 ft of grade. Any soil which caves into the borehole will be removed prior to placement of additional grout.
- The surface completion of the seven monitoring wells will be a 12-inch diameter traffic rated well box set in concrete. The top level of the well box will be raised approximately ½-inch above the pavement level to promote drainage away from the box.

3.2 C-Sand Amendment Wells and Monitoring Wells

The typical well diagrams of the C-Sand AWs and MWs are shown on Figures 4 and 5 of the Implementation Plan, respectively. A total of 56 AWs and four MWs will be installed in the C-Sand. The C-Sand water bearing unit AWs and MWs will be constructed to the following design:

- Total depth of approximately 115 ft bgs. Actual total depths of the wells will be based on the surveyed land surface elevation adjacent to each location and

the target elevations indicated for each well in Table II of the Implementation Plan;

- Boring to be drilled using hollow stem auger drill rig with 8-inch outside diameter by 5 ft long augers;
- The well casing will consist of 2-inch diameter, poly vinyl chloride (PVC) well casing and screen;
- The screen of the AWs will consist of approximately 20 ft of Schedule 80 PVC screen with 0.020-inch machine cut slots. The screen of the MWs will consist of 15 ft of screen with 0.010-inch machine cut slots.
- The screened interval will be placed opposite the C-Sand water-bearing sand encountered from approximately 95 ft to 115 ft bgs. However, the actual depth will be based on the target elevations indicated for each well in Table II of the Implementation Plan.
- The filter pack material to be used for the AWs will be No. 3 Monterey sand, or equivalent. The filter pack of the MWs will be No. 2/12 sand, or equivalent. The filter pack material may be altered following review of sieve analysis reports of soil samples collected during the Phase I geologic reconnaissance program.
- The filter pack will be installed from total depth to 1 ft above the top of the screened interval. The method of placement and settlement of the filter pack is described in Section 2.3;
- The bentonite seal is to consist of 5 ft of ¼-inch WYO-BEN pellets placed in 12-inch maximum lifts. The method of placement and hydration of the bentonite seal is described in Section 2.3;
- The remaining annular seal will consist of a Portland cement grout with approximately 4 percent bentonite powder added by weight. The grout will extend from the top of the bentonite seal to within 3 ft of current grade for the AWs. For the MWs, the grout will be placed to within 2 ft of current grade. The grout mixture and procedure for placement of the annular seal is described in Section 2.3.
- The level of the grout seal in each well will be periodically inspected for one week following installation to observe any settling of the grout. If settlement is observed, additional grout will be mixed and added to bring it within 3 ft of grade. Any soil which caves into the borehole will be removed prior to placement of additional grout.
- For AWs installed outside of the pad for the planned building, a minimum of 2 ft of stickup of the well casing will remain above grade. The well will be capped with a PVC slip cap and marked with wooden stakes and flagging. The piping contractor will trench to the AWs and connect each well to the injection piping according to the specifications.
- The surface completion of the MWs will consist of a 12-inch diameter traffic

rated well box set in concrete from 2 ft bgs to the pavement surface. The top of the box will be raised approximately ½-inch above the surrounding pavement to promote drainage away from the MW.

4. WELL INSTALLATION PROCEDURES

The following procedures are to be used during installation of the AWs and MWs at the Site.

1. During Phase I of the well installation program, continuous cores from 17 AWs were geologically logged. This information was used to determine the completion depths, well screen intervals, and filter pack specification for the remaining 152 AWs and seven MWs and are indicated oin Table II of the Implementation Plan. The 152 remaining AWs are to be drilled without the collection of soil samples for geologic logging. During drilling of the seven MWs, soil samples will be collected for geologic logging at 5 ft intervals using a split-spoon sampler equipped with a sand catcher device but not internal sample rings.

2. Prior to installation, the PVC casing and screen will be decontaminated (if not pre-wrapped. Decontamination of the materials may also be done by high pressure steam cleaning. All personnel handling the decontaminated well materials should wear clean disposable PVC gloves to ensure that the material does not become contaminated prior to installation.

3. After decontamination of all down-hole drilling equipment, the well boring will advanced to the desired well depth. The lead auger/bit used for reaming the boreholes that are not continuously cored will be fitted with a clean wooden plug to maintain a soil-free annulus during reaming.

4. A weighted tape-measure will be used to verify the depth to the bottom of the boring before and after knocking out the wooden plug. The wooden plug is then knocked out with the drill stem rods and 140-pound hammer.

   Note: In cases where heaving sands are encountered, clean potable water will be added to the borehole through the auger to create a hydrostatic head within the augers to prevent heaving sands from entering the augers during installation. Potable water will be obtained from the fire hydrants in Knox Street under permit with the City of Los Angeles. Under no circumstances shall the fire hydrants on the commercial property located south of Knox Street be used due to their connection to an alarm system.

5. When the appropriate depth has been achieved, PVC well screen and casing will be assembled and lowered through the hollow-stem augers. Unless wrapped with plastic from the manufacturer, the well casing and screen for the MWs will be decontaminated before being placed in the borehole. Decontamination of the well casing and screen for the AWs is not required.

6. Once the screen and casing are in place, the sand pack material is poured slowly through the annulus between the interior of the hollow-stem augers and the well casing. The filter pack material to be used for the AWs will be No. 3 Monterey sand, or equivalent. The filter pack of the MWs will be No. 2/12 sand, or equivalent. The augers can be withdrawn during the placement of the filter pack sand, but the tip of the augers must remain below the top of the filter pack throughout the process to prevent caving of formation material into the annulus between the borehole and the well screen. Following placement of the filter pack to a level of 1 ft above the top of the screen, the well will be surged for approximately 10 minutes with a vented surge block to settle the filter pack. The level of the filter pack will then be measured and additional filter pack material added, if necessary, to bring the level a minimum of 1 ft above the top of the screen. The well will then be surged for an additional 5 minutes and the filter pack level again measured. This process will continue until no further settlement of the filter pack greater than 0.05 ft is measured.

7. The final depth to the sand pack will be recorded on the monitoring well construction form (see Appendix A of the Implementation Plan). In addition, the volume of sand used for the gravel pack should be recorded in the Daily Field Report.

8. The bentonite seal is to consist of 5 ft layer of ¼-inch WYO-BEN (or equivalent) coated pellets (for the Lower B-Sand and C-Sand AWs), or ¼-inch bentonite chips (for the Upper B-Sand and Combined Upper/Lower B—Sand AWs), placed in 12-inch maximum lifts. The thickness, hydration, and placement of the bentonite seal are critical to seal-off adjacent water bearing zones. To insure constant hydration of the bentonite pellets in the B-Sand AWs and MWs, a minimum of 2.5 ft of the bentonite seal must be installed below the static water table depth/elevation as verified in adjacent MWs or AWs. The screen interval of the C-Sand wells is sufficiently deep enough to ensure constant hydration of the bentonite seal. Following placement of each bentonite pellet lift, a capped tremie pipe will be used to tamp the pellets in-place and the lift allowed to hydrate for up to 10 minutes before the next lift is placed. Prior to placing the next lift, it will be confirmed that there is a minimum of 2 ft of water above the top of the previous lift. If necessary, additional potable water will be added to the annulus to allow hydration of the next bentonite pellet lift. This placement method will be repeated until the entire 5 ft bentonite seal is placed. As the bentonite seal bentonite seal is placed, the augers can be withdrawn. However, to prevent the formation material from caving around the well screen and casing, at no time shall the base of the augers be allowed to rise above the top of the placed bentonite seal level.

9. The final depth to the bentonite seal and seal thickness will be recorded on the monitoring well construction form. In addition, the volume of bentonite used for the seal should be recorded in the field activity logbook and compared to the calculated volume in the field to verify adequate seal placement.

10. The remaining annular seal will consist of a Portland cement grout with approximately 4 percent bentonite powder added by weight. The mixture will consist of the following; 94 pound bag of Portland Type I/II cement, 4 pounds of bentonite powder, and approximately 8 to 9 gallons of potable water. The bentonite powder and water shall be mixed first and the cement added after it has mixed. The cement and bentonite powder must be loose and free of lumps. The grout will be mixed immediately prior to placement in each individual well. Because of the small annular space between the well casing and the inner wall of the hollow stem auger, a tremie pipe of 1-inch diameter must be used. Because of this small diameter tremie pipe, the grout mixture must have a density between 14.5 and 15.0 pounds per gallon and be fully mixed. The oversight geologist must approve the mix and consistency of each grout mix used using a 1/2-gallon container and a weight scale. The grout will be placed from above the bentonite seal to within 3.5 ft of ground surface using a temporary tremie pipe with the bottom of the pipe placed within 2 ft of the bentonite seal. Grout shall be tremied into the auger annular space as the augers are withdrawn. A minimum of 2 ft of grout shall be maintained in the base of the augers at all times as they are withdrawn. The tremie pipe can be withdrawn during the grouting process, but the tip of the pipe and augers must remain below the top of the grout throughout the process. The well will be periodically inspected in the days following placement of the grout seal to ensure that no settlement occurs and additional grout added to maintain the level approximately 3.5 feet bgs. Any soil or other debris observed on top of the grout seal will be removed prior to adding additional grout, if necessary.

11. The well casing of the AWs will be completed with a minimum of 2 ft of stickup above grade. The well will be capped with a PVC slip cap and marked with wooden stakes and flagging. The piping contractor will trench up to each AW and connect them to the injection piping according to the specifications.

12. The surface completion of the seven monitoring wells will be a 12-inch diameter traffic rated well box set in concrete. The top level of the well box will be raised approximately ½-inch above the pavement level to promote drainage away from the box.

13. Record the applicable geologic and well construction data in the electronic object log and upload the log to the Boeing EDMS.

5. WELL DESTRUCTION PROCEDURES

The purpose of this section is to present the procedures required for the destruction of an AW if well development or water injection testing (WIT) (See Appendix D of the Implementation Plan) indicates that the AW does not have good hydraulic connection to the target water bearing unit (i.e., B-Sand or C-Sand) and can not be used for the addition of amendment.

5.1 Destruction Activities

The well destruction activities addressed in this section include: permits, review of existing well information, equipment assembly, field documentation, and well destruction methods.

5.1.1 Required Permits

LACDHS requires permits for well destruction. LACDHS well destruction permits will require at least 7 working days for the approval process. Well destruction should not proceed until written or verbal approval has been obtained from the LACDHS.

5.1.2 Preliminary Well Review

Prior to initiating the well destruction activities, the Field Coordinator/Supervising Geologist or Task Manager will review all relative information regarding the details of construction and the relative soil and groundwater data associated with the well to be destroyed. The site geologist will inspect the well location for access or obstructions such as equipment storage or materials placement on top of or near the well cover.

5.1.3 Concrete Cutting

Prior to well destruction, the concrete and asphalt surrounding the existing well (if present) will be cut and removed. Enough concrete should be removed to provide sufficient space for the well destruction procedure.

5.1.4 Instrument Calibration and Equipment Organization

Prior to drilling, field equipment will be checked for possible malfunctions and calibrated according to procedures provided by the manufacturer. Field instrument calibration verification will be performed in the field prior to their initial use at least once a day, or when any indication of instrument malfunction is observed. This information may be recorded in the field activity logbook or on the appropriate field meter calibration log.

Following the maintenance and calibration of all field instruments, the equipment and materials necessary to support the well destruction task will be assembled.

5.2 Field Documentation

A field activities log book will be maintained for all field activities associated with the destruction of a well. Entries will be made in waterproof black ink. In the case of an error, corrections will be made by crossing a single line through the incorrect information and entering the correct information. All corrections will be initialed and dated.

The following information will be recorded for each well destroyed:

- Drilling contractor
- Name of field person(s)
- Well number and location
- Well depth and static water level
- Well destruction equipment and method employed
- Date and time of well destruction
- Type and volume of sealant material (volume should be consistent with the anticipated borehole volume)

5.3 Well Destruction Methods

Wells will be destroyed by over-drilling and removal using a hollow-stem auger drilling methods, or LACDHS and Boeing Project Team approved alternate drilling/destruction methods.

The procedures for destroying a well are as follows:

1. Once the surrounding asphalt and concrete (if present) has been removed, the existing well cover and well box (if present) can be removed.

2. Set up the drill rig over the well to be destoyed. With a hollow-stem auger (10-inch minimum diameter), over-drill the existing cement/bentonite seal and sand pack along the entire length of the well.

3. Advance the auger drill string to the desired removal depth (total depth). With the hollow-stem in place, pull the existing well casing through the open augers using the wire-line winch attached to the drill rig. Containerize the well waste materials as described Section 1.4 of this exhibit.

4. Prepare the bentonite-cement grout (sealing material) using the following mixture:

- One 94-pound sack of Portland Type I/II cement
- Approximately 3 to 5 pounds of powdered bentonite
- 6.5 gallons of clean potable water
- The density of the grout mixture should range from 15.6 to 16.2 pounds per gallon and must be verified by the oversight geologist using a calibrated container and weight scale.

NOTE: An alternate approved mixture may be used in place of the bentonite-cement grout mixture above if the alternate mixture complies with the California water well standards.

5. Backfill the vacated boring annulus with a bentonite-cement grout by tremie pipe methods, to prevent the grout from free-falling or becoming diluted or separated during installation. Retract the hollow-stem augers from the borehole at the same rate that the grout is being pumped to prevent the borehole from caving in prior to placement of the sealing material. The grout should be added to the borehole at a speed that will keep the groundwater from rising to the surface and flooding the area around the borehole.

   NOTE: The volume of grout used to seal the borehole should be greater than the calculated volume of the total depth of the borehole.

6. Fill the remaining borehole annulus to approximately 1 ft below the ground or pavement surface with the grout mixture. Record the volume of grout used to seal the borehole.

7. Decontaminate all drilling equipment using a high pressure washer and steam cleaner, or by hand washing with and Alconox solution and two tap water rinses.

8. Contain all soil cuttings, solid wastes, and any displaced groundwater in 55-gallon drums. Seal each drum with a drum lid. Label drums according to the Waste Handling section (Section 3.3) in the Implementation Plan.

9. Place all trash (i.e., spent gloves, paper towels, plastic sheeting, etc.) in plastic garbage bags and dispose of properly.

WELL DEVELOPMENT AND WATER INJECTION TESTING STANDARD OPERATING PROCEDURES FOR LOT 8 – PARCEL C GROUNDWATER REMEDIATION WELL INSTALLATION PROGRAM FORMER BOEING C-6 FACILITY LOS ANGELES, CALIFORNIA

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1. INTRODUCTION

The purpose of this document is to present the standard operating procedures (SOPs) required for development of the 163 bioremediation amendment wells (AW) and seven groundwater monitoring wells (MWs) in Lot 8 – Parcel C of the former Boeing C-6 facility (Site) in Los Angeles, California. The wells are to be installed as part of the groundwater remediation program for the Site. This document also presents the SOPs to be used for water injection testing if an AW displays low recharge during well development. The development and water injection testing will be overseen by a geologist who will be responsible for ensuring that these standard operating procedures (SOP) are followed.

1.1 Objectives

All newly installed AWs and MWs will be developed prior to use but after the surface seals have been allowed to set for a minimum of 72 hours following well completion. The purposes of well development are to;

- Remove fine-grained formation material from the well which may have entered the well screen during installation;
- Clear fine-grained sediment from the well screen openings to increase hydraulic communication with the filter pack;
- Wash fine grain sediment from the filter pack and increase hydraulic communication with the formation of the water bearing unit; and
- Restore the groundwater properties disturbed during the well installation process.

Removal of fines from the screens of the AWs is particularly important, as any fine-grained formation materials could be forced into the formation during amendment injection activities and could inhibit flow and reduce well efficiency.

If any AW displays slow recharge rates during development, a water injection test (WIT) will be performed. The primary purpose of this test is to evaluate the competency of the AW for use as an amendment well. The WIT will also provide hydraulic data that will be used to better plan injection activities.

2. WELL DEVELOPMENT SOP

Development of wells consists of initial development (pre-development) during construction of the well, to settle the filter pack, and development of the well a minimum of 72 hours following placement of the surface seal to wash the well screen and increase hydraulic communication with the formation of the water bearing units. The SOPs for these tasks are described below.

2.1 Pre-Development

Initial development of the AWs and MWs (pre-development) will be performed during emplacement of the well filter pack to ensure that the filter pack has settled. This pre-development procedure is covered in the Well Construction and Destruction SOP (Appendix C, Section 4), but is included here for completeness and cross-reference. Once the well screen and casing are in place, the filter pack material is poured slowly through the annulus between the interior of the hollow-stem augers and the well casing. The filter pack material to be used for the AWs will be No. 3 Monterey sand, or equivalent. The filter pack of the MWs will be No. 2/12 sand, or equivalent. The augers can be withdrawn during the placement of the filter pack sand, but the tip of the augers must remain below the top of the filter pack throughout the process to prevent caving of formation material into the annulus between the borehole and the well screen. Following placement of the filter pack to a level of 1 ft above the top of the screen, the well will be surged for approximately 10 minutes with a vented surge block to settle the filter pack. Because the C-sand AWs will be constructed with Schedule 40 PVC casing and Schedule 80 screens, care must be taken during the use of the surge block to prevent damage to the joint between the two different types of casing/screen. Following surging, the level of the filter pack will then be measured and additional filter pack material added, if necessary, to bring the level a minimum of 1 ft above the top of the screen. The well will then be surged for an additional 5 minutes and the filter pack level again measured. This process will continue until no further settlement of the filter pack greater than 0.05 ft is measured.

2.2 Well Development

This section presents the equipment and procedures to be used during well development.

2.2.1 Equipment

The equipment to be used during well development includes the following:

- Well development rig equipped with boom, winch, submersible pump, electric generator, and high pressure washer and steam cleaner;
- 2-inch diameter vented rubber surge block;
- 1.5-inch diameter steel bailer;
- 2-inch diameter submersible electric pump (e.g., Grunfos Redi-Flo 2) with electric cable, steel retaining cable, and Nalgene or Teflon discharge hose;
- Calibrated container and stop watch to measure pump discharge rate;
- 1-liter Imhoff Cone;
- Electronic water level sounder with 0.01 ft increments; and

- Water quality meters for monitoring pH, electroconductivity, turbidity, temperature, and dissolved oxygen

- Water Development Record form (included in Appendix A of the Implementation Plan)

2.2.2 Well Development Procedures

Prior to development, total depth, the feel of the bottom of the well (i.e., soft or hard bottom), and the static water level in the well will be measured and recorded in the Well Development Record form. A copy of the Well Development Record form is included in Appendix A – Field Forms of the Implementation Plan.

Because the C-sand AWs will be constructed with Schedule 40 PVC casing and Schedule 80 screens, care must be taken during the use of surge blocks, bailers, and pumps to prevent damage to the joint between the two different types of casing/screen.

The volume of water contained in the well casing (casing volume) will be calculated using the well diameter, total depth, and the static depth of water measured prior to the start of development activities. The casing column conversion factor for 2-inch inside diameter (ID) schedule 40 Poly vinyl chloride (PVC) well casing is 0.175 gallons per linear foot of casing. Well development will then proceed following the steps below.

1) Wells will first be bailed of any accumulated sediment in the bottom of the well using a steel bailer to remove as much sediment as possible. The bailing time duration, total depth of the well, and volume of water and sediment removed at the end of bailing will be estimated and noted on the Well Development Record.
2) Wells will then be surged using a 2-inch diameter, vented rubber surge block for a period of no less than 1 minute for every linear foot of well screen (e.g., a minimum of 20 minutes for a 20 ft length of well screen) to wash water in and out of the well screen through the slotted openings. The surge time duration and total depth of the well will again be measured and recorded on the Well Development Record.
3) The well will again be bailed of any accumulated sediment. The suspended sediment load should be monitored during bailing using a 1-liter Imhoff Cone. Bailing of sediment should be performed until the sediment load decreases to a point that a submersible pump can be used. This point is typically when less than ½- to 1-inch of sediment settles in the bottom of a 1-liter Imhoff Cone. The bailing duration, well total depth, and the volume of water and sediment bailed from the well should again be measured and recorded in the Well Development Record.
4) An electric submersible pump and a water level pressure transducer with data wire leading to the surface will then be inserted into the well and lowered to the pumping depth approximately 2 ft above the base of the well. The transducer's data wire will be connected to a laptop computer for monitoring the water levels during the pumping phase of development. The pre-pumping water level will be measured with an electronic sounder and recorded on the Well Development Record.
5) The submersible pump should be started and adjusted to the maximum pumping rate of the pump (i.e., approximately 4 gallons per minute (gpm)). The water level in the well should be monitored with the electric sounder every 5 minutes and recorded in the Well

Development Log. Every 5 minutes during pumping, the sediment loading in the discharge water should be monitored with Imhoff Cone, and the water quality parameters (i.e., pH, temperature, electroconductivity, turbidity, and dissolved oxygen) monitored with field instruments and recorded in the Well Development Record.

6) If the water level in the well drops to the pump intake during pumping, the pumping rate should be decreased until a sustained pumping rate is achieved. The well should be pumped at this sustained rate until the sediment loading goal and the water quality parameters stabilize to within 10 percent of previous readings.

7) If the sediment loading does not decrease to less than ¼- to ½-inch of sediment in the Imhoff Cone within 10 minutes of pumping, the pump should be removed and the well surged for 10 minutes and bailed again to wash fine-grained sediment from the well screen and filter pack, and the pumping process resumed.

8) The well should be pumped until the water quality parameters stabilize to within 10 percent of previous measurements, and the turbidity drops to below 100 NTUs. If the turbidity goal is not reached within 2 hours of total development time (Surging, bailing and pumping), the pump should be turned off, but remain in the well and the water level recovery monitored with the sounder at 2 minute intervals until 80 percent of the static water level is recovered, or 10-minutes, which ever is less. The 80 percent recovery is defined as 80 percent of the distance between the initial static water level and the pumping level measured at the end of the pumping stage. Following this recovery stage, the pump and level transducer can then be removed from the well. The development results should then be evaluated by the Project Team to assess if further development is required or if the well should be identified as unacceptable. If filter pack material is observed in the bailed sediment, video camera logging of the well may be performed to assess the source of the filter pack (e.g., cracked well screen).

9) Once the pump is removed from the well, the total depth of the well should be measured and the conditions in the bottom (i.e., hard or soft bottom) of the well recorded in the Well Development Record. This measurement shall be repeated the following day to allow any sediment to settle to the base of the well. If sediment is detected in the base of the well following pump removal or the following day, the well may have to be bailed (with a clean bailer) to remove this sediment. This sediment may have been washed from the well screen but did not enter the pump intake during the pumping stage and settled in the base of the well.

10) If the sediment loading goal is reached within the 2 hours of total development time, the pump should be turned off and the water level recovery monitored as described above until 80 percent of the static level is achieved, or 10 minutes of recovery time is measured. The time to achieve 80 percent (or more) recovery should be noted in the Well Development Record.

11) For MWs, once the turbidity goal is achieved and the water quality parameters stabilize to within 10 percent of previous readings, development of the MW is considered complete.

12) If an AW takes longer than 10 minutes to achieve 80 percent of static water level recovery, the AW should be flagged as a "Slow Recharge Well" and a Water Injection Test (WIT) performed following the WIT SOPs presented in the following section.

13) Following well development, all used equipment (i.e., surge block, bailer, winch cable, pump, electronic sounder, level transducer and data cable, and the water quality meters) should be decontaminated between each well by use of a high pressure washer and steam cleaner, or hand washing with an Alconox solution and a double tap water rinse followed with a distilled water final rinse.

2.2.3 Waste Management

Storage and disposal of the investigation derived wastes (IDW) generated during the well development program will be coordinated with the Boeing Waste Management Specialist Mr. Scott Latimore a minimum of 2-weeks prior to mobilization for each phase of the program.

Where possible, bailed sediment will be separated from well development water and placed in roll-off bins to be located in a designated waste handling area on the Site. The driller will transport the separated sediment from the well location to the roll-off bins using a soil hopper and a forklift.

Well development water and decontamination rinse water will be placed in a 6,000 gallon holding tank located in a designated waste handling area on the Site. The driller will be responsible for pumping all decon rinse water and well development water into the holding tank.

All debris and trash will be collected and disposed of daily by the driller.

All IDW containers will be labeled with an adhesive waterproof label and waterproof marker and catalogued on a daily basis. Each container label will contain the following information:

- Client (generator) identification (name and address);
- Name and phone number of Boeing Waste Management Specialist;
- Date(s) generated;
- Container Contents (example: well cuttings from well AW-112, development purge water from wells AW-97 and AW-98, etc);
- Estimated volume or capacity; and
- Physical state of material (solid or liquid)

The Field Coordinator will be responsible for maintaining a compiled list of all of the IDW containers generated on a daily basis. A waste inventory form is included in Appendix A. This list is to be provided to the Boeing Waste Management Specialist every Friday during the drilling program.

3. AMENDMENT WELL WATER INJECTION TEST SOP

The evaluation of AWs for acceptance will follow the Well Construction Plan flow Chart (Figure 3 of Implementation Plan). During the AW development process described in the proceeding section, AWs will be evaluated as to their recharge capability. If an AW requires more than 10 minutes to achieve 80 percent recovery of the static water level once the pumping stage is completed, the AW will be flagged as a "Slow Recharge Well" and a water injection test (WIT) may be performed. The equipment and SOPs required for the WIT are described below.

3.1 Equipment

The equipment required for the proposed WIT includes the following:

- 500 gallon holding tank with bottom drain fitting and filled with potable tap water mounted on trailer or flatbed truck;
- Electric pump connected between holding tank's bottom drain fitting and manifold capable of pumping up to 17 gpm;
- In lieu of use of the holding tank and pump, it may be possible to use long lengths of fire hose and the fire hydrants on Knox Street to provide the water for the WIT;
- Two 25 ft lengths of 1-inch diameter hose with appropriate connections to the pump discharge, the valve manifold, and the end placed in the top of the well casing;
- Water flow meters and valves used by Arcadis G&M, Inc. during the Building 2 Area amendment well testing program will be used to conduct the WIT.
- Pressure transducer and datalogger (rated to a minimum 75 ft head);
- Water level sounder with 150 ft length.

Using a pressure transducer with an aboveground datalogger allows the collection and recording of the height of water in the well casing during the WIT. The water level sounder will be used during the WIT to monitor water levels within the casing of any adjacent AWs or MWs.

3.2 Water Injection Test Procedures

The WIT will be implemented following the Well Construction Plan Flow Chart (Figure 3 in the Implementation Plan). The AW WIT will evaluate the specific injection capacity of the well (i.e. incrementally fill and maintain the water level in the well casing and monitor the injection rate. If the WIT injection rate is greater than 2 gpm, the AW is acceptable for use

during the amendment injection program. If the injection rate is less than 2 gpm, the AW shall be rejected for use as an amendment well.

During the WIT, nearby AWs or MWs, if present may be used to provide additional data on the effect of the injection as a secondary check on the response of the WIT on the AW.

The data collected during the WIT will include the following:

- The water level in the injection well and any adjacent AWs or MWs will be recorded during injection, along with the corresponding injection flow rate (read from the digital flow meter).
- The flow rates achieved at each interval will be recorded.
- A volume totalizer will be used to monitor the total volume of water injected into the well over the course of testing.

The field log sheet to be used for data collection is included in the Field Forms in Appendix A of the Implementation Plan.

The WIT will be conducted without applying excess pressure to the well-head. This will simulate the water injection rate under conditions most likely to be applied during future amendment addition events. The WIT shall be conducted as follows:

1) Prior to the test, a City of Los Angeles Hydrant Meter will be attached directly to the fire hydrant source. Fire hydrant sources may be too far away from the AW being testing. In lieu of a fire hydrant source, a 500 gallon mobile holding tank and electrical pump can be used. All fittings should be secured before commencing the test. The oversight geologist will document the injection equipment used and the fittings used to connect to the well head.

2) Check the calibration of the flow meter in the test apparatus, if this has not already been done beforehand.

3) Measure static water level in the injection well.

4) Measure static water level in the adjacent wells that will be used as observation points. The observation wells should be within 100 feet of the AW being tested.

5) Place the discharge hose in the well, suspending a pressure transducer connected to a data logger in the well at the same time. The recording interval for the data logger should be set at 15 second intervals. Since this logger will be exposed to the full range of the head pressure, it needs to have a minimum full-scale response of 75 ft. Record the position of the logger.

6) The test should last approximately 30 minutes, or not more than 500 gallons of injected water. During the test, injection flow rates, water levels (pressures) and total volume of water injected should be recorded on the log sheet provided in Appendix A of the Implementation Plan. Periodic water level measurements should be taken from the adjacent observation wells by hand (if available) and recorded on the WIT form.

7) Set the water level sounder to 15 ft above the static water table level. Initiate flow to the well, beginning with a flow rate of 2 to 3 gpm. Gradually increase the flow rate until the water level in the well has risen to the water level sounder sensor. Maintain this sustained atmospheric injection rate for 5 minutes. Record flow rate and water level. Record the water level in the adjacent observation well(s) (if available).

8) Reposition the water level tape 30 ft above the static water level.

9) Increase the flow rate until the water level in the well has risen to 30 ft above the initial (static) level. Maintain this injection rate for 5 minutes. Record flow rate and water level. Record water level in adjacent monitor well(s) (if available).

10) Reposition the water level tape 45 ft above the static water level.

11) Increase the flow rate until the water level in the well has risen to 45 ft above the initial (static) level. Maintain this injection rate for 5 minutes. Record flow rate and water level. Record water level in adjacent observation wells (if available).

12) Reposition the water level tape to 2 ft below the top of the well-head, about 60 ft above the static water level.

13) Increase the flow rate until the water level in the well has risen to the water level sensor (near ground surface), approximately 60 ft above the initial (static) level. Maintain this injection rate for 5 minutes. Record flow rate and water level. Record water level in adjacent observation wells (if used).

14) Stop water addition. Record times and water levels as the water in the casing falls. The logger should capture this information, so the manual measurements will serve as a check on the data. Record water levels in monitor well(s).

Calculate specific capacity (flow rate/height of water in casing) for the four steady-state height of water in casings and injection rates. If the AW can accept injection of water at rates greater than 2 gpm, the AW is acceptable for use. If the injection rate is less than 2 gpm, the AW can not be used, and the cause of the failure of the AW shall be evaluated. And the well replaced.

Following the WIT, all down hole equipment must be decontaminated by hand washing with an Alconox solution, double rinse with tap water, and a final rinse with distilled water.

Well Testing Record forms will be provided to the Boeing Task Manager for review. Data logger data will be graphed and evaluated to assess the specific injection capacity of the AW

and AW acceptance or the requirement to destroy the unacceptable well and re-install the AW according to the Well Construction Plan Flow Chart.